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# Stryker Suitability Challenges in a Complex Threat Environment

Don McKeon

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# STRYKER SUITABILITY CHALLENGES IN A COMPLEX THREAT ENVIRONMENT

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# BACKGROUND

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## T&E Review

**Operational Testing:**

**Effectiveness**

**Suitability**

**A<sub>o</sub> (Operational Availability)**



# BACKGROUND

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## Operational Effectiveness:

**Does it work ?**

## Operational Suitability:

**Can we keep it working ?**



# BACKGROUND

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## Operational Suitability:

**Can we keep it working ?**

### Major Drivers:

Reliability

Repairability

Spare Parts

Test Equipment

Trained Technicians

Transportation & Storage



## BACKGROUND

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### Operational Availability (Ao):

**Is it there when we need it ?**



## BACKGROUND

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**Operational Suitability is a major determinant of  $A_o$ .**

$$A_o = \text{UPTIME} / (\text{UPTIME} + \text{DOWNTIME})$$





# Suitability . . . at what cost?

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**Typical IOT&E Evaluation Results:**

**EFFECTIVENESS:** approximately \_\_\_\_\_ success rate

**SUITABILITY:** approximately \_\_\_\_\_ success rate



# Suitability . . . at what cost?

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## Typical IOT&E Evaluation Results:

**EFFECTIVENESS:** approximately 90% success rate

**SUITABILITY:** approximately \_\_\_\_\_ success rate



# Suitability . . . at what cost?

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## Typical IOT&E Evaluation Results:

**EFFECTIVENESS:** approximately 90% success rate

**SUITABILITY:** approximately 60 - 75% success rate



# Suitability . . . at what cost?

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## Typical IOT&E Evaluation Results:

**EFFECTIVENESS:** approximately **90%** success rate

**SUITABILITY:** approximately **60 - 75%** success rate

**Typical Decision after IOT&E:** Begin fielding ASAP, even before . . . .

**Suitability problems are addressed**

**Reliability is improved**

**Maintenance procedures are mature**

**Training is complete**

. . . . .

. . . . .



# Suitability . . . at what cost?

---

## Typical IOT&E Evaluation Results:

**EFFECTIVENESS:** approximately **90%** success rate

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**Typical Decision after IOT&E:** Begin fielding ASAP, even before . . . .

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Reliability is improved

Maintenance procedures are mature

Training is complete

. . . . .

. . . . .

**Why field before addressing these problems? Urgent Combat Need**



# Suitability . . . at what cost?

---

## Typical IOT&E Evaluation Results:

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Typical Decision after IOT&E: Begin fielding ASAP, even before . . . .

Suitability problems are addressed

Reliability is improved

Maintenance procedures are mature

Training is complete

. . . . .

. . . . .

Why field before addressing these problems? **Urgent Combat Need**

**The QUESTION: How much does it cost us to do business this way?**



# BACKGROUND

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## 2006 DOTE Annual Report to Congress:

### Dr. McQueary's 3 Observations:

1. OT&E is too often the place where performance deficiencies are discovered
- 2.
- 3.



# BACKGROUND

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## **2006 DOTE Annual Report to Congress:**

### **Dr. McQueary's 3 Observations:**

- 1. OT&E is too often the place where performance deficiencies are discovered**
- 2. DoD Acquisition is too slow (warfighters need more rapid fielding of new technologies)**
- 3.**





# **BACKGROUND**

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## **2006 DOTE Annual Report to Congress:**

### **Dr. McQueary's 3 Observations:**

- 1. OT&E is too often the place where performance deficiencies are discovered**
- 2. DoD Acquisition is too slow (warfighters need more rapid fielding of new technologies)**
- 3. Operational Suitability is too low, and needs to improve.**



# Suitability . . . at what cost?

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## DAU Research Study Proposal

Investigate various types of systems

Total of 5 or 6, several from each service

Criteria:

- Recently fielded

- Evaluated to be Effective but not “fully” Suitable

Examine performance of systems wrt suitability

Determine suitability cost drivers

Evaluate suitability trends

Sponsor Decision: Start with one program, work from there . . . . .

First Program Selected: **STRYKER Family of Vehicles**

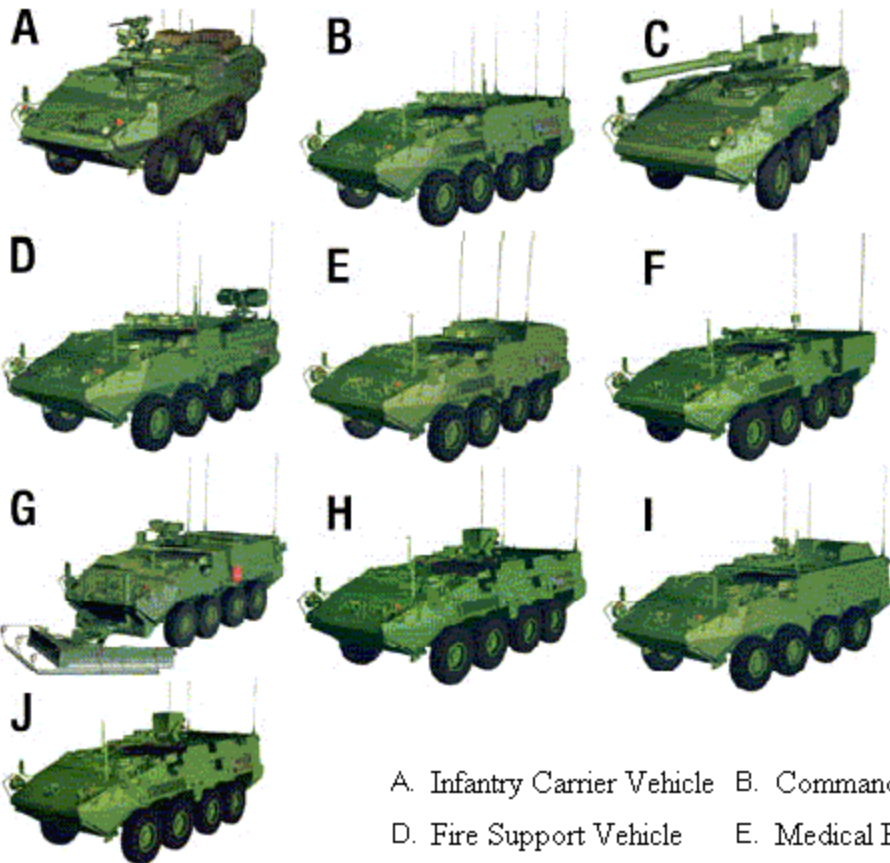
Additional Study Candidates: TBD



# Stryker Family of Vehicles

## STRYKER FAMILY OF VEHICLES

 In service with the US Army



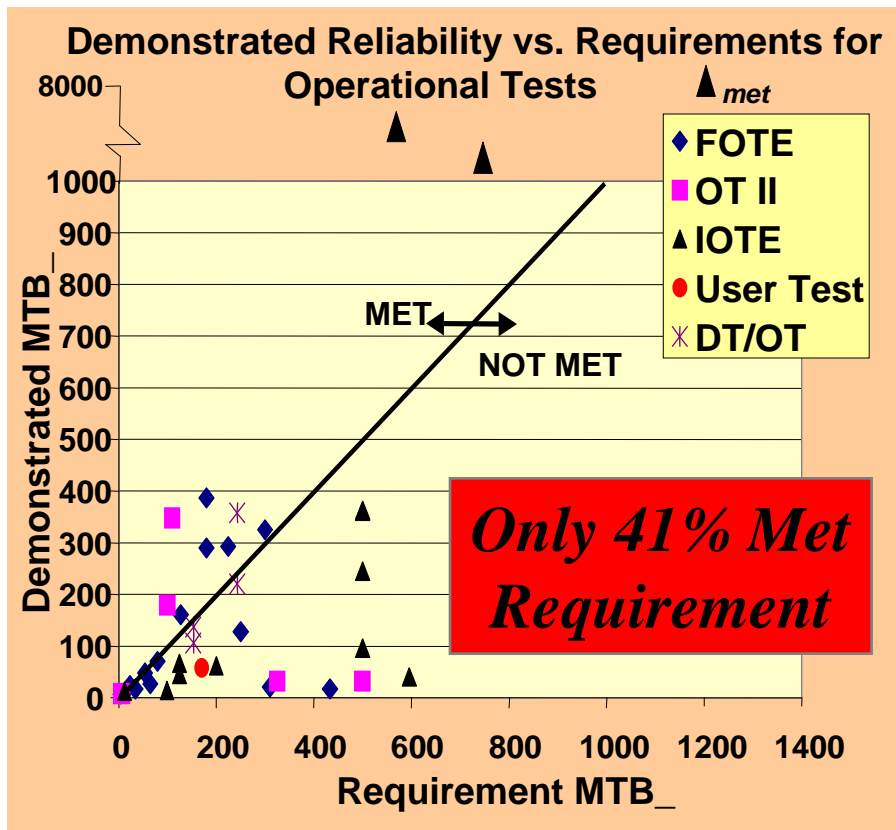
- |                             |                             |                       |
|-----------------------------|-----------------------------|-----------------------|
| A. Infantry Carrier Vehicle | B. Command Vehicle          | C. Mobile Gun System  |
| D. Fire Support Vehicle     | E. Medical Evacuation       | F. Mortar Carrier     |
| G. Engineer Squad Vehicle   | H. Anti-tank Guided Missile | I. NBC Reconnaissance |
| J. Reconnaissance Vehicle   |                             |                       |



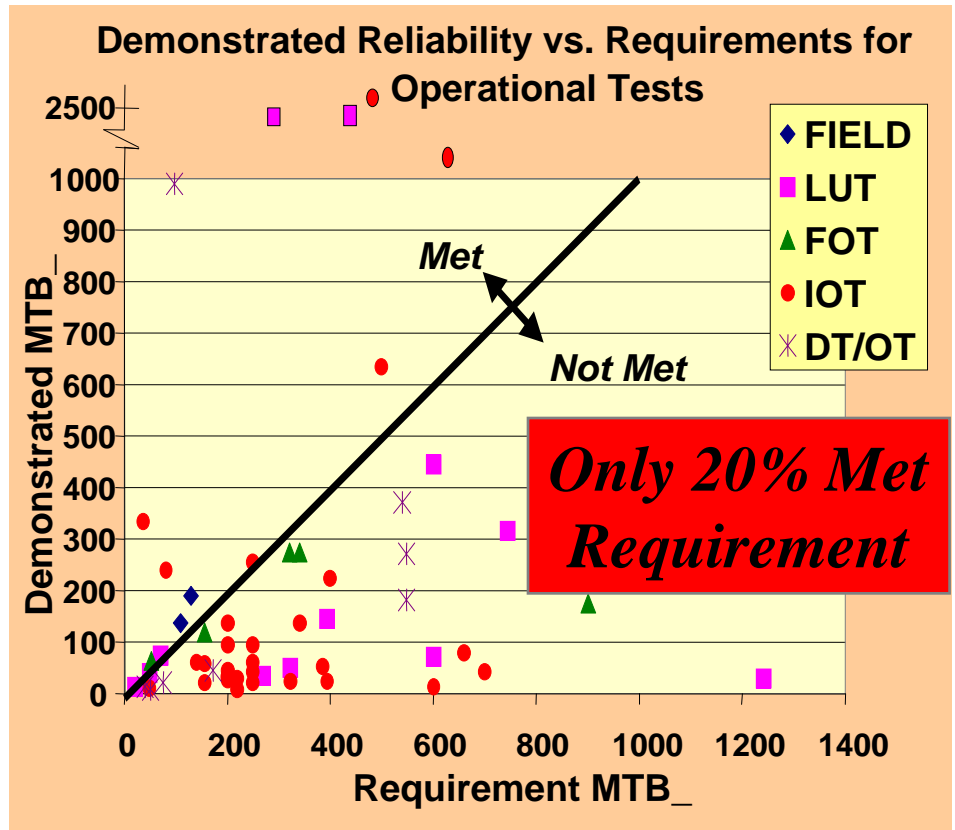


# Now, back to Suitability . . . .

## ATEC Reliability Track Record

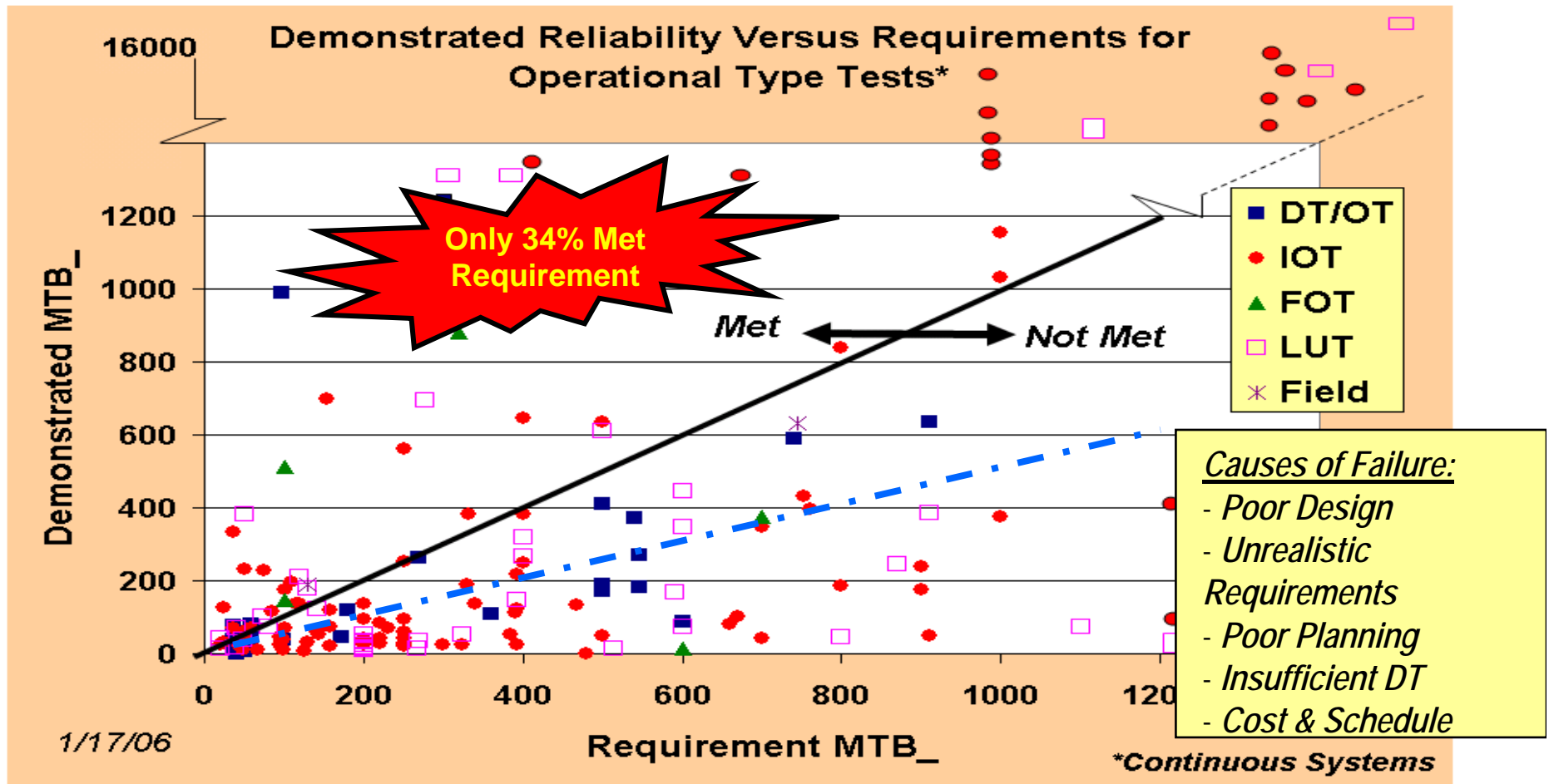


1985-1990



1996-2000

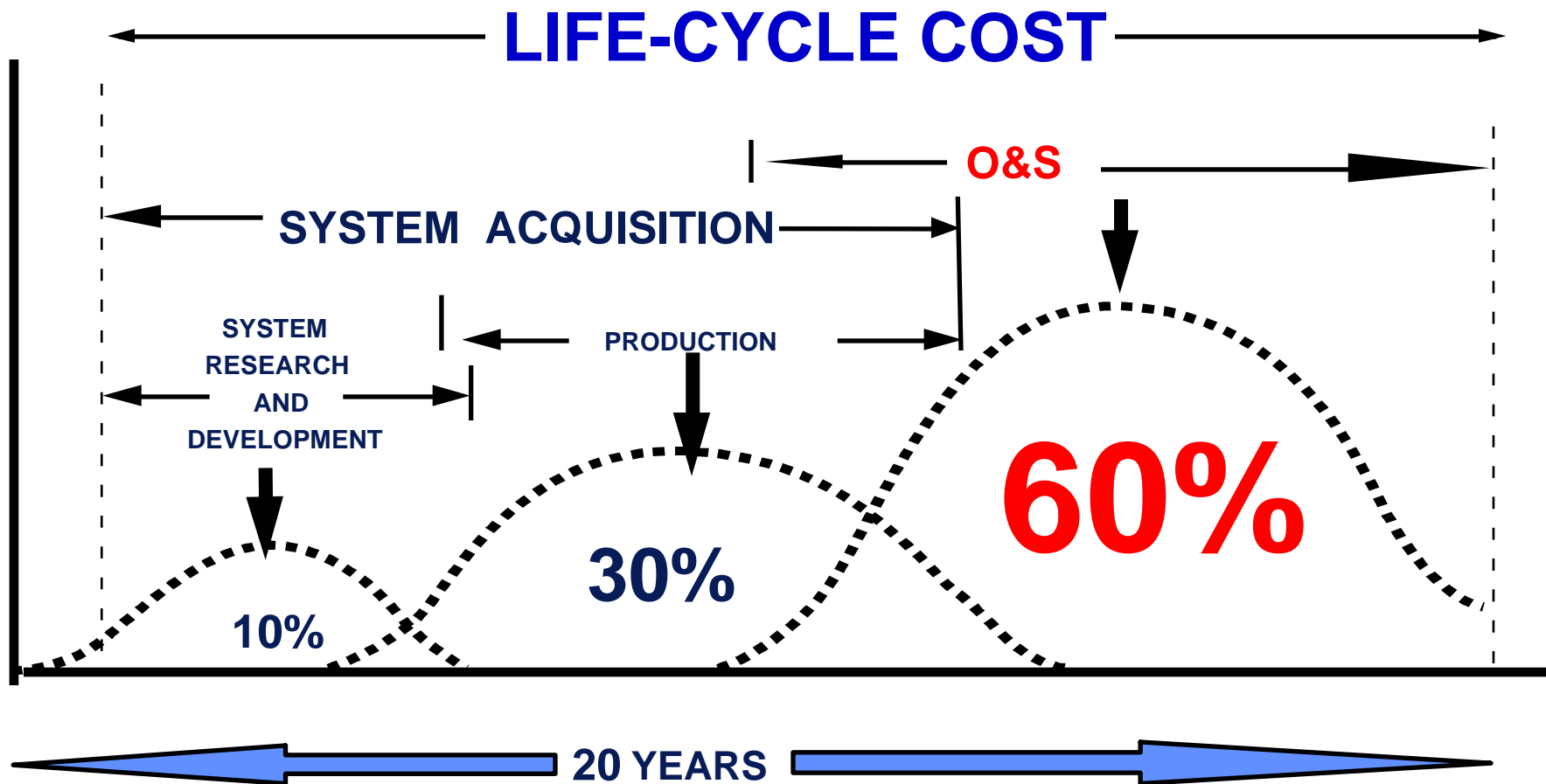
Most Of Our Systems Fail To Achieve Reliability Requirements In OT  
*... And The Trend Appears To Be Continuing Downward* source: ATEC



*Amongst Systems Which Did Not Meet Reliability Requirements In OT, 75% Of Them Failed To Achieve Half Of Their Requirement*

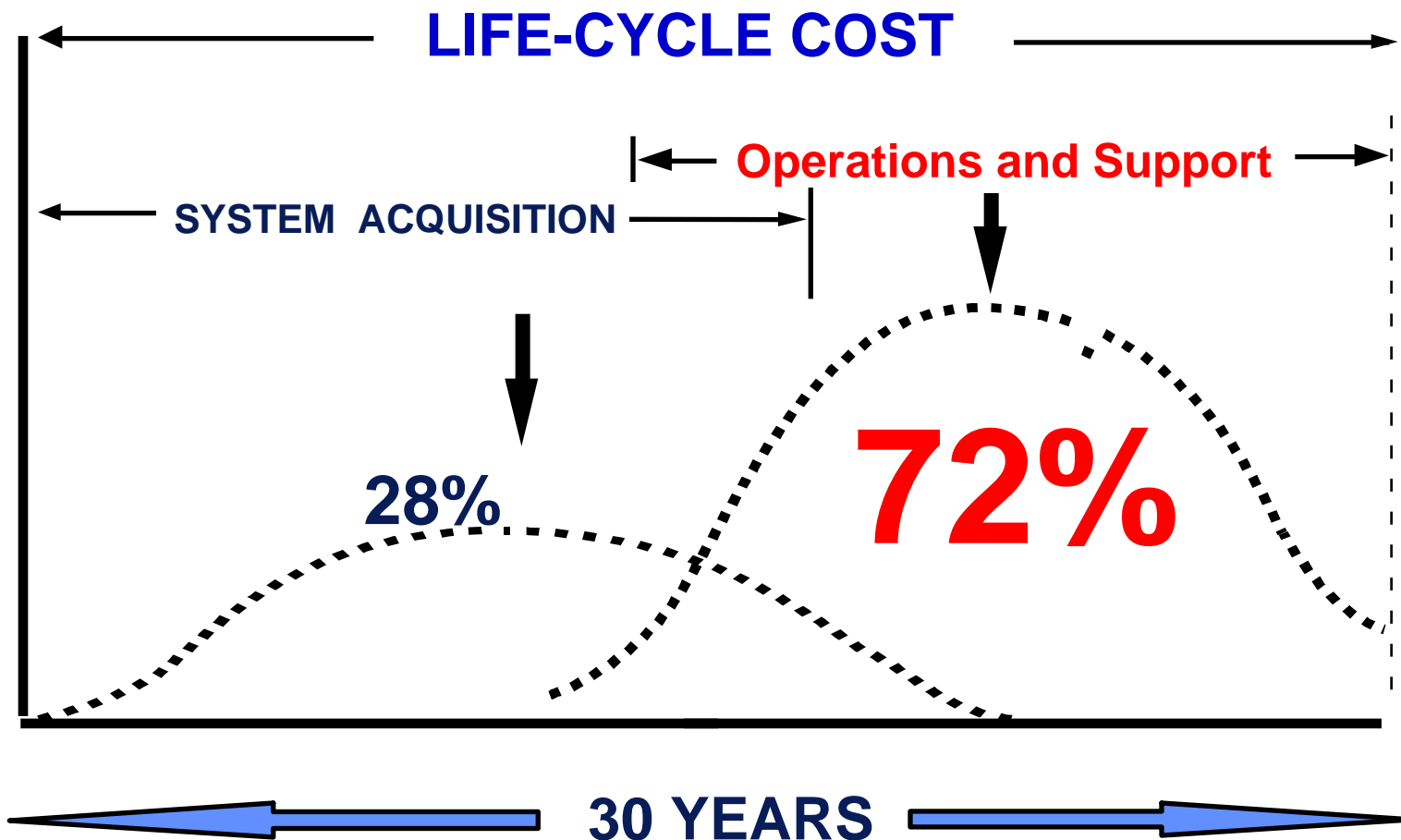


# LCC Distribution



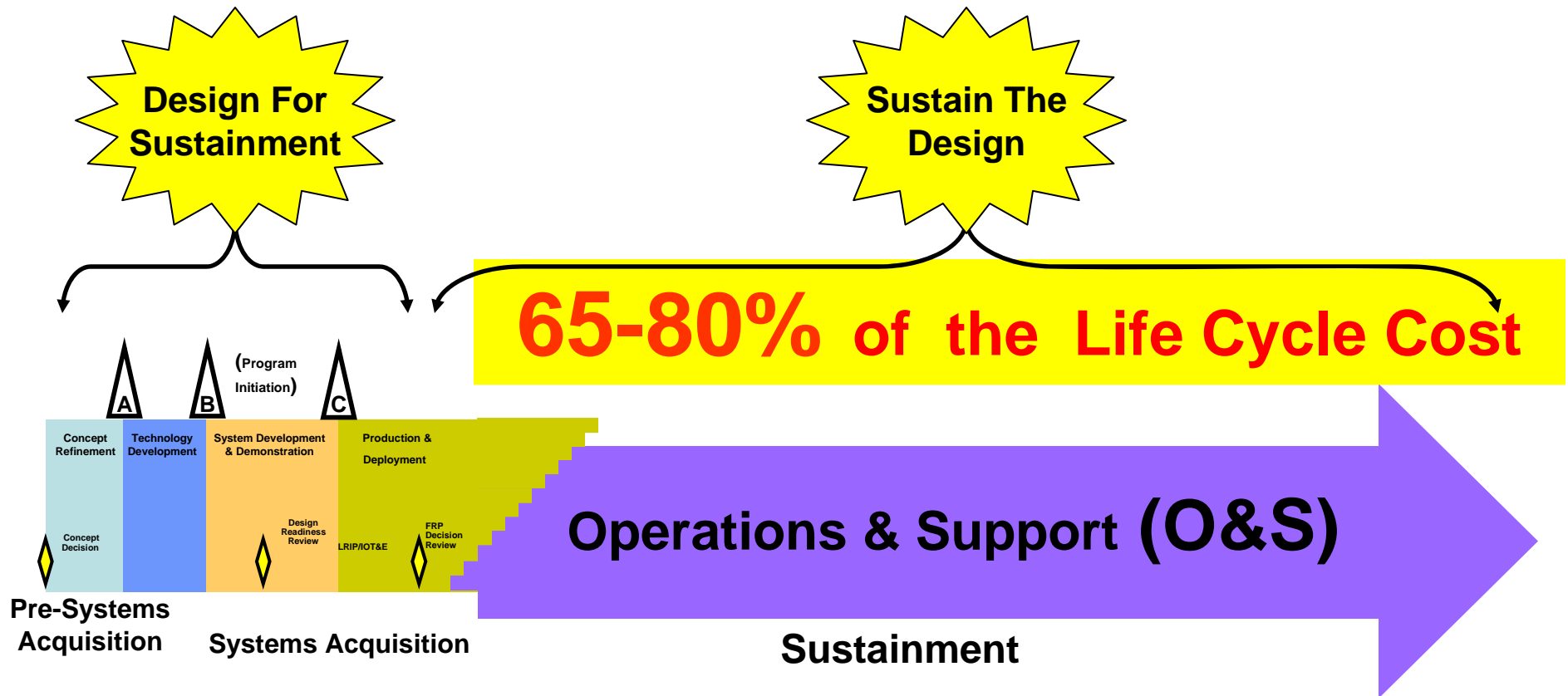


# LCC Distribution





# Life Cycle Management



**O&S Costs Are Determined Early In The Acquisition Phase**

**USD(AT&L) Strategic Goals Emphasize Sustainment Outcomes Throughout The Life Cycle Management Process**

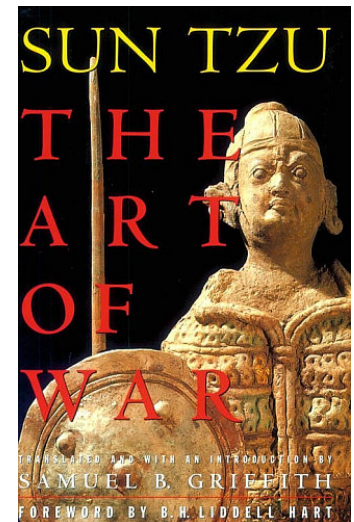




# Life Cycle Costing Considerations

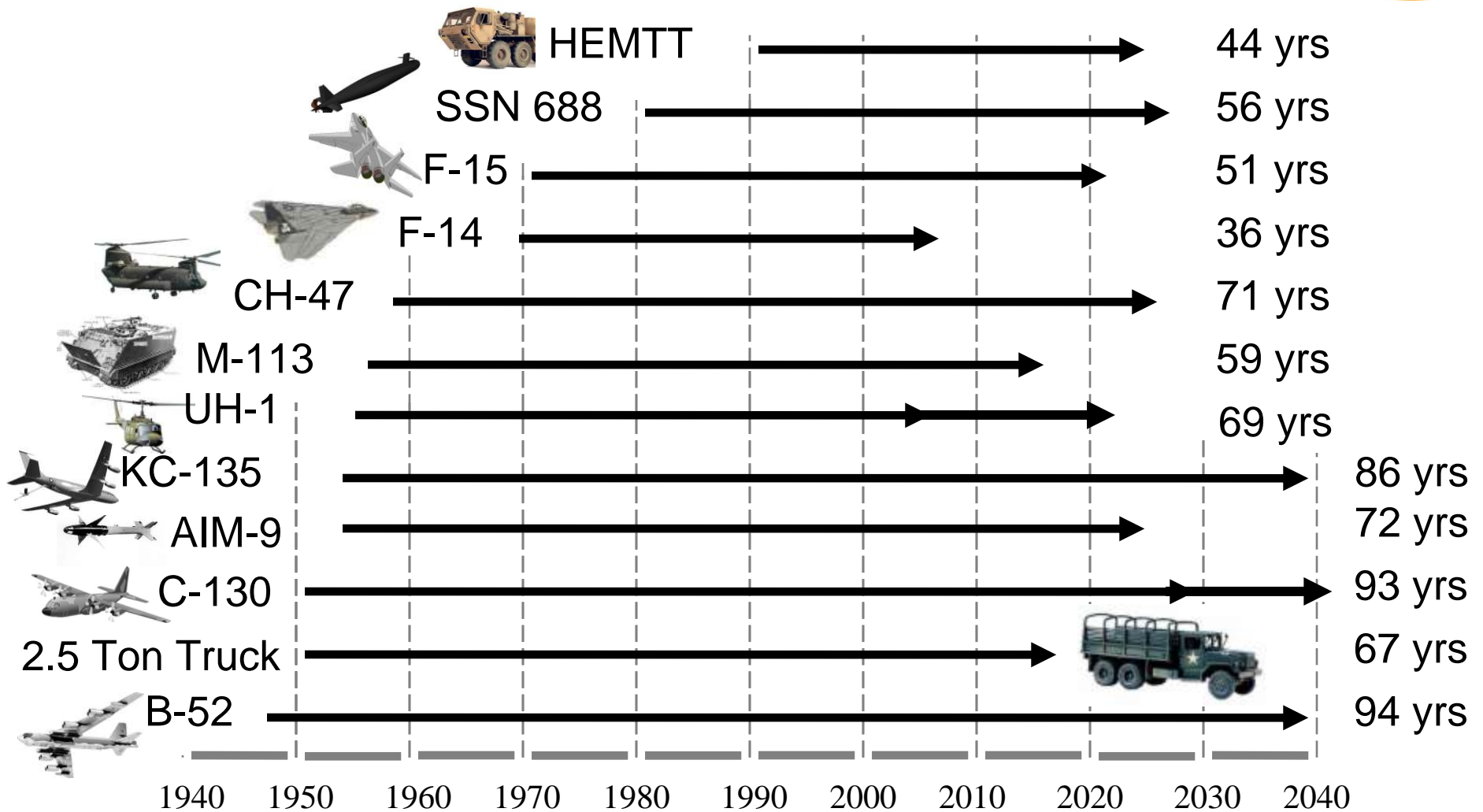
“As Government expenditures, those due to broken down chariots, worn-out horses, armor and helmets, arrows, and crossbows, lances, hand and body shields, draft animals and supply wagons will amount to 60% of the total.”

**Sun Tzu (The Art of War, 6<sup>th</sup> Century B.C.)**





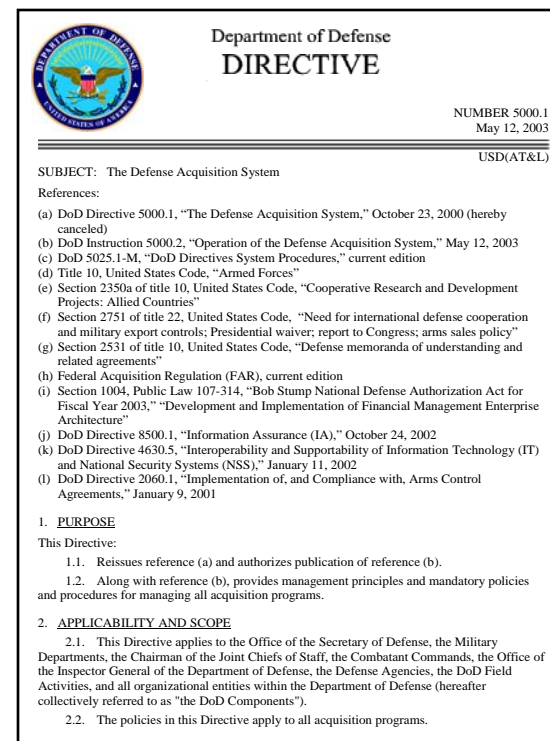
# Defense System Life Cycles





# DoD Directive (5000.1)

**“PMs shall consider supportability, life cycle costs, performance, and schedule comparable in making program decisions.”**





# AT&L Memo: 22 Nov 2004

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(Subj: Total Life Cycle Systems Management (TLCSM) Metrics)

**Emphasizes use of PBL (Performance-Based Logistics) for all weapons**

**Provides Specific Definitions (and Formulas) for the following metrics:**

- 1. Ao (Operational Availability)**
- 2. Mission Reliability**
- 3. TLCS Cost per Unit of Usage**
- 4. Cost per Unit of Usage**
- 5. Logistics Footprint**
- 6. Logistics Response Time**



THE UNDER SECRETARY OF DEFENSE

3010 DEFENSE PENTAGON  
WASHINGTON, DC 20301-3010

NOV 23 2005

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS  
(ATTN: SERVICE ACQUISITION EXECUTIVES)

SUBJECT: Total Life Cycle Systems Management (TLCSM) Metrics

The Defense Business Board recommended to the Deputy Secretary of Defense that the Department aggressively pursue implementation of Performance-Based Logistics, for all its weapons, new and legacy.

In a memorandum dated August 16, 2004, my predecessor directed measuring performance in terms of Operational Availability, Mission Reliability, Cost per Unit of Usage, Logistics Footprint, and Logistics Response time. For consistency, this memorandum provides specific definitions of those metrics for use across the Department (attached). I direct their use as the standard set of metrics for evaluating overall TLCSM.

I also direct the TLCSM Executive Council to develop a "TLCSM Metrics Handbook," with specific metrics, formulas and calculation methodologies. It will be used in performance-based contracts and for sustainment oversight. The handbook will also define supporting data requirements that should be incorporated into emerging logistics information systems.

The principal point of contact for administration of the handbook is Mr. Lou Kratz, Assistant Deputy Under Secretary of Defense (Logistics Plans and Programs), 703-614-6327, [Louis.Kratz@osd.mil](mailto:Louis.Kratz@osd.mil).

Kenneth J. Kratz

Attachment:  
As stated



# JROC Memo: 17 Aug 2006

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(Subj: Key Performance Parameters Study Recommendations and Implementation)

1. Endorsed Mandatory **“MATERIEL AVAILABILITY” Key Performance Parameter (KPP)** for all MDAPs and Select ACAT II and III  
With 2 Supporting Key System Attributes (KSAs):
  - A. **Materiel Reliability**
  - B. **Ownership Costs**
2. Endorsed ENERGY EFFICIENCY KPP for selected programs, as appropriate
3. Endorsed TRAINING KPP for selected programs, as appropriate
4. Did not endorse requirement for mandatory KPPs for these criteria:  
COST  
TIME and/or SCHEDULE  
SUSTAINMENT  
COALITION INTEROPERABILITY  
FORCE PROTECTION AND SURVIVABILITY



JOINT REQUIREMENTS  
OVERSIGHT COUNCIL

THE JOINT STAFF  
WASHINGTON, D.C. 20318-8000

JROCUM 161-06  
17 August 2006

MEMORANDUM FOR: Under Secretary of Defense for Acquisition, Technology,  
and Logistics  
Commander, US Joint Forces Command  
Vice Chief of Staff, US Army  
Vice Chief of Naval Operations  
Vice Chief of Staff, US Air Force  
Assistant Commandant of the Marine Corps

Subject: Key Performance Parameter Study Recommendations and  
Implementation

1. The Joint Requirements Oversight Council (JROC) approved the Key Performance Parameter (KPP) Study recommendations. The JROC endorses the implementation of a mandated Materiel Availability KPP with supporting key system attributes of materiel reliability and ownership cost for all Major Defense Acquisition Programs (MDAPs) and select ACAT II and III programs. The JROC also endorsed selectively applying an Energy Efficiency KPP and a System Training KPP, as appropriate.
2. To better ensure the correct KPPs are selected, the JROC endorsed the use of KPP reference sheets produced as part of this study. The KPP reference sheets will be used as an aid in the process of identifying and validating potential KPPs for any acquisition program.
3. Implementation of the study recommendations will be concurrent with the publishing of the next revision of CJCS 3170-series documents. The revision will incorporate the details of the execution and will be coordinated for final release by 31 October 2006. Specific JROC implementation due backs and approved recommendations are enclosed.

  
E. P. GIAMBASTIANI

Admiral, US Navy  
Vice Chairman  
of the Joint Chiefs of Staff

Enclosure





# JROC Approved\* Mandatory Sustainment KPP and KSAs

- **Single KPP:**
  - **Materiel Availability** ( $= \frac{\text{Number of End Items Operational}}{\text{Total Population of End Items}}$ )
- **Mandatory KSAs:**
  - **Materiel Reliability** (MTBF) ( $= \frac{\text{Total Operating Hours}}{\text{Total Number of Failures}}$ )
  - **Ownership Cost** (O&S costs associated w/materiel readiness)
- **For mission success, Combatant Commanders need:**
  - Correct number of operational end items capable of performing the mission when needed
  - Confidence that systems will perform the mission and return home safely without failure
- **Ownership Cost provides balance; solutions cannot be availability and reliability “at any cost.”**

***\*JROC Approval Letter JROCM 161-06 Signed 17 Aug 06;  
Revised CJCS 3170 will put into Policy***





# "Proposed" Life Cycle Sustainment Outcome Metrics (2006)

- **Materiel Availability (KPP\*)**
  - A Key Data Element Used In Maintenance And Logistics Planning
- **Material Reliability (KSA\*)**
  - Provides A Measure Of How Often The System Fails/Requires Maintenance
  - Another Key Data Element In Forecasting Maintenance/Logistics Needs
- **Ownership Cost (KSA\*)**
  - Focused On The Sustainment Aspects Of The System
  - An Essential Metric For Sustainment Planning And Execution
  - Useful For Trend Analyses – Supports Design Improvements/Modifications
- **Mean Downtime**
  - A Measure Of How Long A System Will Be Unavailable After A Failure
  - Another Key Piece Used In The Maintenance/Logistics Planning Process
- **Other Sustainment Outcome Metrics May Be Critical To Specific Systems, And Should Be Added As Appropriate**

\* Sustainment KPP & KSAs Included In Revised Draft CJCSM 3170

**These 4 Life Cycle Sustainment Outcome Metrics Are Universal Across All Programs And Are Essential To Effective Sustainment Planning**



# DUSD AT&L Metrics Evolution

## USD AT&L TLCSM Metrics (Nov 05)

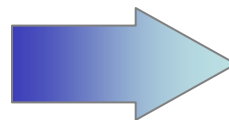
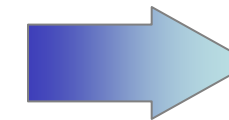
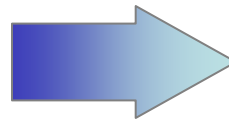
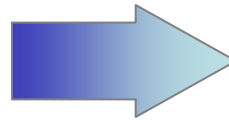
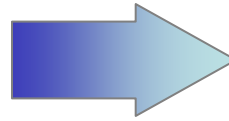
- *Operational Availability ( $A_o$ )*

- *Mission Reliability*

- *Total Life Cycle System Cost per Unit of Usage*
- *Cost Per Unit of Usage*

- *Logistics Footprint*

- *Logistics Response Time (LRT)*



## DUSD L&MR Life Cycle Sustainment Metrics (Mar 07)

- **Material Availability (1)**
- *Key Performance Parameter (KPP)*  
(per Aug 06 JROC Memo)

- **Material Reliability (2)**
- *New Key System Attribute (KSA)*  
(per Aug 06 JROC Memo)

- **Ownership Cost (3)**
- *New Key System Attribute (KSA)*  
(per Aug 06 JROC Memo)

- *No Corresponding New Metric*

- **Mean Down Time (MDT) (4)**



# DUSD (L&MR) Memo – 10 March 2007

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## Subj: Life Cycle Sustainment Metric Outcomes

. . . In July 2006, JROC established *mandatory* KPP: “**Materiel Availability**” along with KSAs: “**Material Reliability**” and “**Ownership Costs**”

This memo (March 2007) provides definitions of these terms and adds one additional parameter: “**Mean Down Time**”

BOTTOM LINE: Specific program goals for these “**four materiel readiness outcomes**” will be established early in the concept decision process and refined throughout the system development process. Status towards these goals should be reported at Program Reviews (DAB, DAES, etc.):

1. Materiel Availability
2. Material Reliability
3. Ownership Costs
4. Mean Down Time



### **14 Life Cycle Sustainment (LCS) Enablers**

- 1. Performance Based Logistics (PBL)**
- 2. Corrosion Prevention**
- 3. Item Unique Identification (IUID)/Serialized Item Management (SIM)**
- 4. Tech Data/IETM**
- 5. Condition-Based Maintenance (CBM+)**
- 6. Continuous Process Improvement (CPI)**
- 7. Title 10 Partnering Requirements - 50/50**
- 8. Depot Maintenance Plan**
- 9. Obsolescence Plan, Diminishing Manufacturing Sources and Material Shortages (DMSMS)**
- 10. Training**
- 11. Integrated Supply Chain Management (SCM)**
- 12. Radio Frequency Identification (RFID)**
- 13. Predictive Modeling**
- 14. Long Term Performance Based Agreements (PBA)**

# PBL Guidance Evolution, 1998-2008



- Fiscal Year 1998 Section 912(c) of the National Defense Authorization Act (not shown)
- “Secretary of Defense Report to Congress: Actions to Accelerate the Movement to the New Workforce Vision” in Response to Section 912(c) of the NDAA for FY 1998 (Apr 1998)
- Product Support for the 21<sup>st</sup> Century: Report of the Department of Defense (DoD) Product Support Reengineering Implementation Team Section 912(c) (Jul 1999)
- Product Support for the 21st Century: A Year Later (Sep 2000)
- Product Support for the 21st Century: A Program Manager’s Guide to Buying Performance (Nov 2001)
- DoDD 5000.1 The Defense Acquisition System (May 2003) and DoDI 5000.2 Operation of the Defense Acquisition System (May 2003)
- Defense Acquisition Guidebook (DAG), Chapter 5 (2004 & After) (not shown)
- Performance Based Logistics: A Program Manager’s Product Support Guide (Mar 2005)

*“My vision of the acquisition workforce 10 years from now is one that is smaller and in fewer organizations; is focused on managing suppliers, rather than supplies; and is focused on the total cost of ownership to provide and support high quality goods and services required by our warfighting men and women.”*

-- Secretary of Defense William Cohen, April 1998



# Stryker Suitability Study

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- **Research Objective**

- To conduct a research study to quantify the difference between projected O&S costs (associated with the RAM requirement) and the actual costs associated with the achieved level of operational suitability. That is, quantify the costs of not achieving adequate levels of operational suitability.

**Research Proposal:**

**Examine suitability performance**

**Determine suitability cost drivers**

**Evaluate suitability trends**



# Process

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- **Phase 1- Initial Program (Stryker)**
  - a. Understand the problem
  - b. Define detailed study objectives
  - c. Collect data
  - d. Analyze data and build models
  - e. IPR at T&E Conference - Hilton Head
  - f. Acquire additional data as needed
  - g. Draft report
  - h. Finalize report
  
- **Phase 2 - Analysis of 5 additional programs covering multiple types**



# Data Collection

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- Stryker PM Team (TACOM Warren, MI)
- AEC RAM Directorate – Aberdeen (ATEC)
- OTC Reps (Ft. Hood, TX)
- AT&L Rep (Pentagon, WASH DC)
- IDA (Arlington, VA)
- LMI (Falls Church, VA)
- GDLS CDRL Data (Warren, MI)
- Fort Lewis Stryker Team (Ft Lewis, WA)





# Findings & Observations

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- **Warfighters very satisfied with Stryker performance in-theatre**
- **Brigade Commanders extremely happy with ICLS**
- **High Operational Readiness Rates, but ORR is prioritized over support costs**
- **Very High Op Temp in-theatre**
- **Operational Environment much different than expected**
  - **Mission Profile not accurate (80% Primary Roads)**
  - **Harsh usage – roads, curbs, higher tire pressure, excess weight**
  - **Excessive stresses on vehicle:**
    - **Over-inflated tires – auto system doesn't work (log burden)**
    - **High tire replacement rate**
    - **Wheel spindles fatigue cracks**



# Findings & Observations

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- **Combat re-configurations necessary for safety:**
  - **Armor, RPG Cage, Sand Bags ... add excessive weight to vehicle (affecting reliability and performance)**
- **Army did not buy Tech Data Pkg – “Prohibitively expensive” . . . risk to government**



# Other Findings

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- Immature Maintenance Procedures- many procedures have not been validated in IETMs (interactive electronic tech manuals) lead to:
  - “***Tribal System Maintenance***” from experienced crews ( “. . . that new book isn’t any good . . . . . this is the way it worked on the M113, so do it like this”)
- With Kr support to maintain vehicles, soldier crews develop “***rental car mentality***” . . .
  - Lack of ownership mentality . . . overly dependent on contractor
  - Sometimes they forget the basics (oil check)
  - One vehicle lost because pre-mission checks were ignored



# Other Findings

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- **Stryker initial deployment/fielding was extremely accelerated to meet urgent combat need**
  - **Result was that Army was doing these things concurrently:**
    - **Testing**
    - **Producing**
    - **Fielding**
    - **Conducting combat operations**
- **The threat and the operational environment were much different than anticipated**



# **Cost Per Mile Analysis**



# Cost Per Mile (CPM)

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- **CPM is a planning tool used to project future budget requirements.**
- **No specific value of CPM required by contract.**
- **Govt/Kr both calculate CPM independently, and use results to negotiate parts cost forecasts to determine purchasing requirements .**
- **This research project resulted in an independent computation of CPM.**



# Data Collected

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- CDRL A003 (Aug 2006)
  - Parts Consumption Report (for ~ 1 yr)
  - Good quality data (possibly some errors in mileage or dates)
- CDRL A004 (Aug 2006)
  - Repairable Items Repair Cost Summary
  - Most repair items have estimates or quotes
  - ~ 26% of total consumable parts\_\_\_\_ % parts



# Cost Per Mile Analysis

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$$\text{Cost Per Mile} = \frac{\text{Labor} + \text{Replacement Parts} + \text{Part Repair}}{\text{Total Vehicle Mileage}}$$

Labor : Average of \$4.73M per brigade

Replacement Parts : from CDRL A003 Consumption Report

Part Repair : No historical data for many parts

Existing data from CDRL A004 (Repairable  
Items Repair Cost Summary

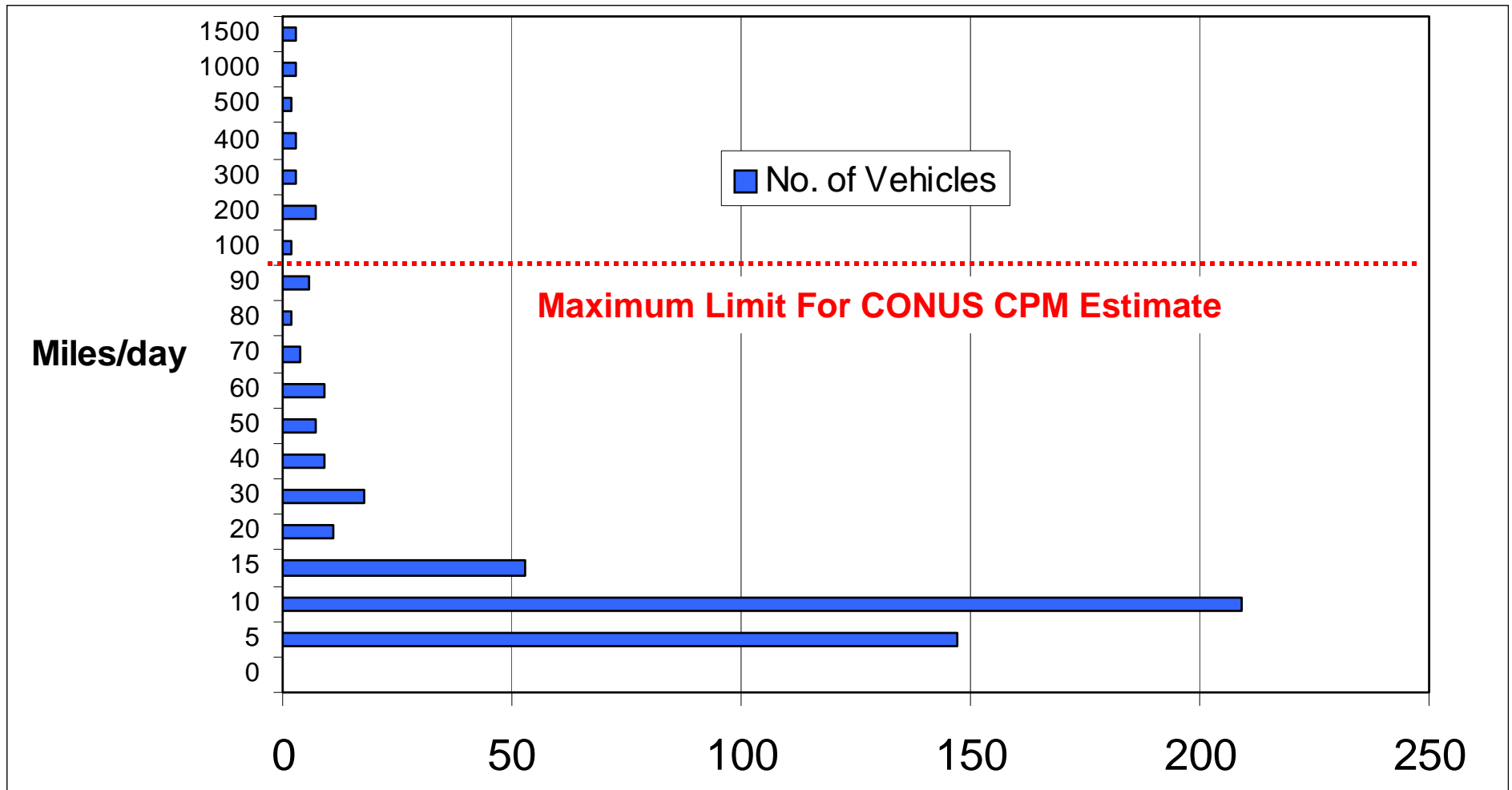
Vehicle Mileage : Does not exist for all vehicles

Questionable accuracy





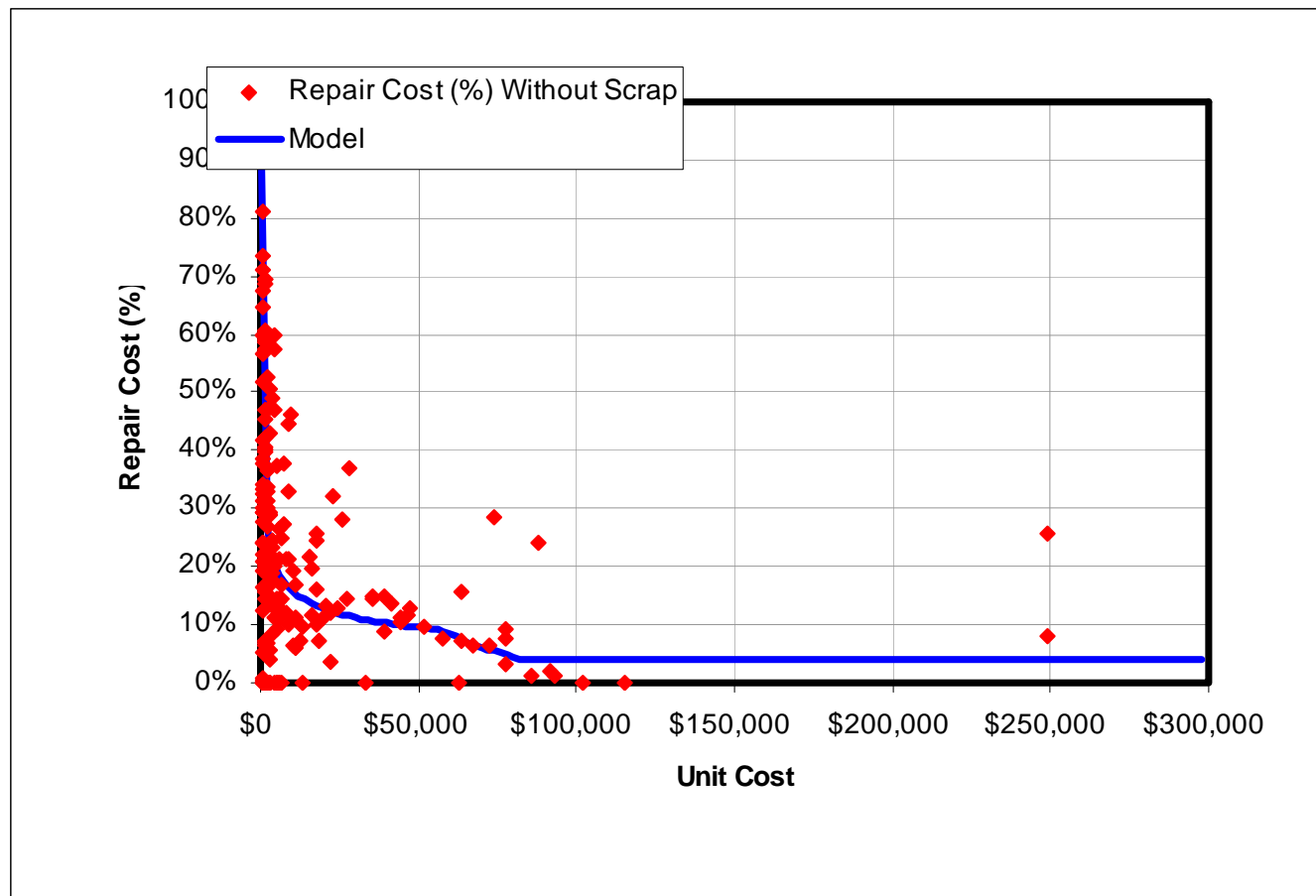
## Vehicle Miles Per Day From A003 (CONUS)





# Repair Costs Parametric Model

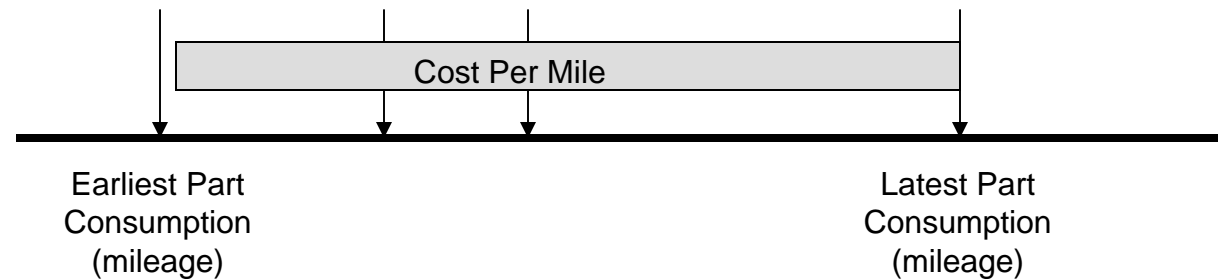
- Parametric model to estimate repair costs as a function of replacement cost.
- Did not factor in warranty items





# Estimating the Repair Cost per Mile

For each vehicle



- Estimate cost per mile from consumption report.
  - Vehicle mileage
  - Quantity consumed
  - Average repair cost (including scrap but not including warranty)
  - Correction needed to raw data.



# CONUS Cost/Mile

## ICLS Labor, Replacement Parts, Part Repair

Vehicle Type	No. Vehicles	Repair Cost in Computation	Total Mileage in Computation	Spares/ Repair Parts Cost/mile	Miles Per Day	Total CPM
ICV	345	\$1,581,641	218,138	\$7.25	7.56	\$9.41
MCV	101	\$279,921	22,504	\$12.44	5.39	\$14.59
ATGM	43	\$172,499	20,200	\$8.54	6.67	\$10.69
ESV	29	\$395,797	28,970	\$13.66	9.51	\$15.82
FSV	33	\$165,540	18,558	\$8.92	6.90	\$11.08
MEV	35	\$66,682	17,405	\$3.83	6.16	\$5.99
RV	161	\$559,520	110,313	\$5.07	7.32	\$7.23
<b>All vehicles</b>	<b>747</b>	<b>\$3,221,599</b>	<b>436,088</b>	<b>\$7.39</b>	7.31	\$13.30

Assumptions: Each vehicle < 5k total miles, < 100 miles/day average, 30% repair cost for Power Pack



# Deployed Cost per Mile

ICLS Labor, Replacement Parts, Part Repair

Vehicle Type	No. Vehicles	Repair Cost in Computation	Total Mileage in Computation	Spares/ Repair Parts Cost/mile	Miles Per Day	Total CPM
ICV	315	\$8,225,102	1,108,756	\$7.42	36.93	\$9.57
MCV	70	\$765,983	120,708	\$6.35	22.08	\$8.50
ATGM	52	\$1,393,062	218,260	\$6.38	43.50	\$8.54
ESV	28	\$587,658	134,119	\$4.38	64.33	\$6.54
FSV	27	\$486,028	95,890	\$5.07	36.94	\$7.22
MEV	38	\$223,414	79,945	\$2.79	25.70	\$4.95
RV	126	\$2,303,741	317,632	\$7.25	31.72	\$9.41
All vehicles	656	\$13,984,989	2,075,310	\$6.74	35.59	\$7.95

- Model assumes \$4.73M per brigade
- Higher miles/day for Deployed vehicles results in lower Total Cost Per Mile

Assumptions: Each vehicle < 20k total miles, < 400 miles/day average, 30% repair cost for Power Pack



# Cost Per Mile (CPM) Estimates

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- CPM estimate - \$17.19 (GAO 04-925, including labor, parts & repair)
- CPM estimate - \$18.78 (Stryker R-TOC Brief)
- CPM estimate - \$18.23 (based on M113 methodology w/Stryker adjustments)
- CPM estimate - \$14.53 (based on initial 4 month deployment data)
- CPM estimate (GDLS) - \$13.52 garrison  
\$ 8.88 deployed
- DAU CPM estimate – \$ 13.30 garrison  
\$ 7.95 deployed



# Conclusions

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**Stryker was not designed for the threat it is facing.**

**Stryker was not designed for the operational environment it is experiencing.**

**Accelerated deployment resulted in many concurrent activities:  
Testing, Production, Deployment, Combat**

**Stryker is doing the job. Crews are overcoming obstacles.**

**Costs of marginal suitability is not determined. Data not available.**



# Conclusions

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## OPERATIONAL READINESS RATE (ORR):

- **Contractual requirement:  $ORR \geq 90\%$** 
  - Does not include GFE (base vehicle configuration only)
- **Stryker consistently above requirement**
  - Recent ORR data point: 97% (20 Feb 07)
- **Cost-plus-fixed-fee contract motivates GDLS to meet ORR . . . .**
  - However, contract does not incentivise controlling costs . . . risk to government
  - Example – to repair cracked hydraulic reservoirs in power pack, whole power pack is replaced in field





# Conclusions

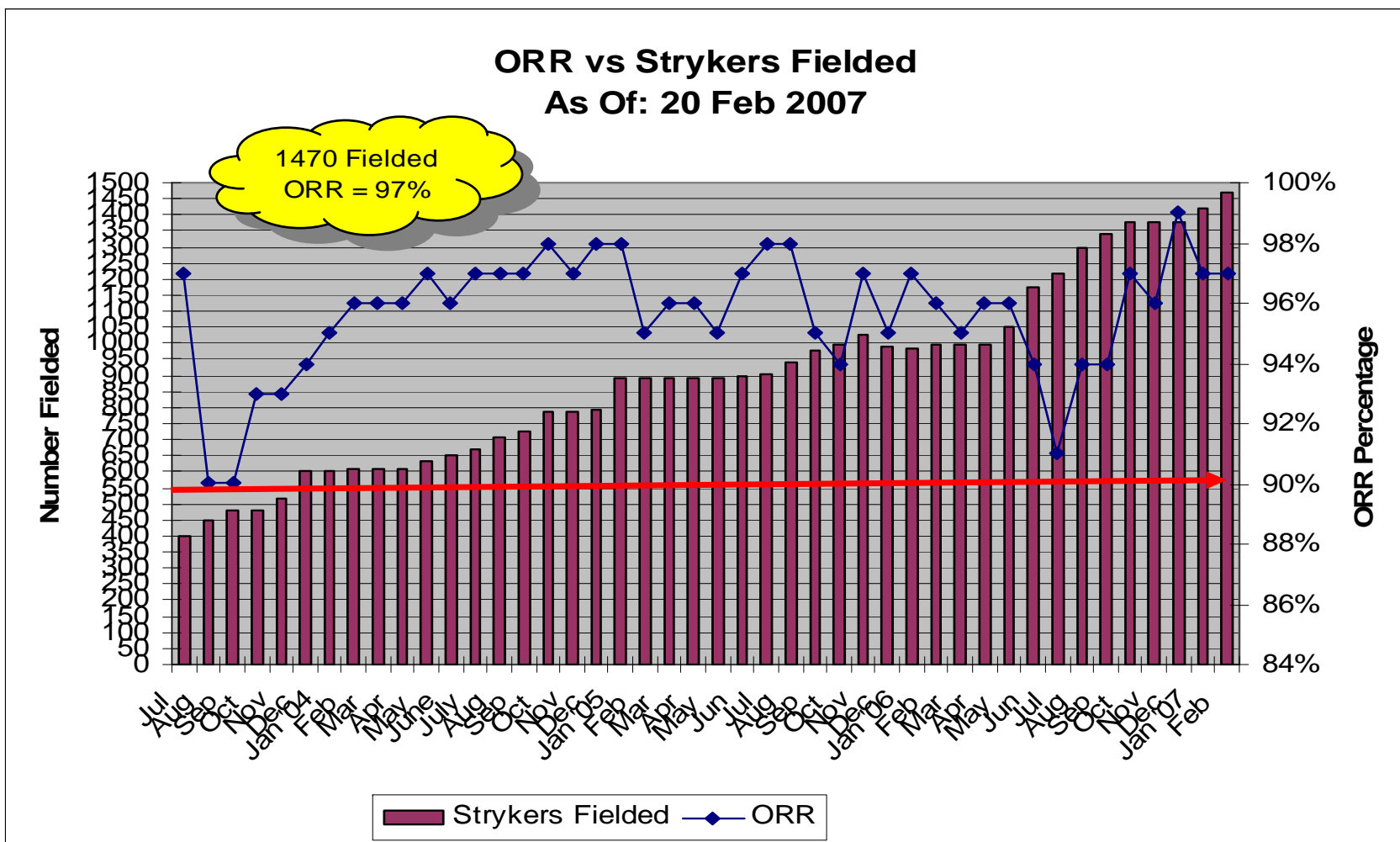
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## **OPERATIONAL READINESS RATE (ORR):**

- **Operational Readiness Rate not necessarily consistent with traditional  $A_o$  (Operational Availability)**
  - RAM issues can be masked by ORR
- **Mission Completion vs. Subsystem Failure**
  - Possibly leads to overestimating system reliability due to non-reporting on individual subsystem (component) failures
  - Multi-mission vehicle – with subsystem failures, system can still perform alternate missions
- **Reporting Criteria Issue:**
  - ORR vs. MTBF of individual subsystems



# Stryker Fleet Readiness





# Conclusions

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## **RELIABILITY ISSUES:**

- **Reliability requirement as defined in ORD are not appropriate**
  - 4.3.1.3. The Stryker (vehicle only, excluding GFE components/systems) will have a reliability of 1000 mean miles between critical failure (i.e., system aborts).
- **Reliability issues and cost drivers found during DT/OT correlate well with fielded experience**



# Conclusions

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## **OPERATIONAL ENVIRONMENT:**

- **Field usage much harsher than planned**
  - e.g., higher tire pressure, roads, curbs, weight (armor, sandbags)
- **Mission Profile says 80% XCountry, 20% Primary Roads**
  - in-theater mission just the opposite . . . most missions in urban environment (police action) on paved roads
- **OpTempo very high (>10X)**
  - High OpTempo may improve reliability numbers, but beats up equipment
  - With low usage, seals can dry up, humidity can build up in electrical components
- **Changes in mission & configuration are putting excess stress on vehicle: armor/sandbags, over inflated tires, going over curbs**
  - replacing 9 tires/day (>3200 tires/yr)
  - wheel spindles developing fatigue cracks
  - drive shafts breaking
  - prescribed tire pressure is 80 PSI, however, with slat armor/sandbags – must maintain >95 PSI
  - 95 PSI is a logistics burden on operators
    - Must be maintained by the soldier (tire inflation system can't do it)
    - Soldiers must check tire pressure more than 3 times per day to maintain 95 PSI



# Conclusions

## **TACTICAL CONSIDERATIONS:**

- **Slat Armor & cage design (additional 5000 lb) is effective for many RPG threats, but negatively impacts size, weight and performance of Stryker**
  - **Causes multiple problems for safe and effective operation**
    - Slat armor on rear ramp too heavy - greatly strains lifting equipment
      - Occasionally, crews must assist raising/lowering ramp
    - Bolts on rear ramp break off frequently with normal use
    - Slat armor bends with continued ops . . . can cover escape hatches and block rear troop door in ramp
    - Slat armor interferes with driver's vision
    - Slat armor difficult for other traffic to see at night . . . Safety hazard in urban environment
    - Slat Armor prohibits normal use of exterior storage racks
  - **Significantly impacts handling/performance in wet conditions**
    - Adds excessive strain on engine, drive shafts, differentials
  - **Impairs off-road ops, larger footprint**
- **Though not designed primarily for the urban fight (MOUT), Stryker is well-suited for it**
  - **Unlike M-1, Stryker is “ghostly” quiet . . . tactical advantage**
- **Stryker overall OIF performance significantly better than HUMVEE, BRADLEY or M-1 in this environment**